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ABSTRACT

This paper discusses strategies that can be used to realize interdisciplinary instruction at the secondary level and details a sample curriculum that employs themes related to human nutrition. The Secondary Level Interdisciplinary Curriculum is organized around five thematic units that present nutrition issues highly relevant to adolescents: Alternative Eating, Food Safety, Physical Activity, Disordered Eating, and Special Concerns in Nutrition for Teenagers. (Contains 11 references.) (WRM)

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A MODEL AND STRATEGIES FOR REALIZING SECONDARY LEVEL INTERDISCIPLINARY INSTRUCTION

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Educational reform currently advocates a movement towards connecting the disciplines by employing multidisciplinary, interdisciplinary, thematic, or integrated approaches to curriculum and instruction (Lederman & Niess, 1997, Marsh, 1997). Lederman and Ness discuss the "semantics" of the previous terms: They contend that integrated instruction is where the traditional disciplinary boundaries are "dissolved," whereas with interdisciplinary instruction, "the integrity of the various academic disciplines remains clear" (p. 57). In thematic instruction, an overarching concept/topic is provided to interrelate separate disciplines and respective topics, e.g., "food safety" might connect history (the genesis/progression of sanitation, inspection, and labeling laws and regulations), health (food-borne diseases), and science (microbiology, toxins). Marsh (1997) defines multidisciplinary instruction as teaching, over the same time period, lessons from two or more disciplines (e.g., science and social studies) that correspond to the same topic, the latter taking the form of a theme (e.g., global warming) to provide explicit focus. In multidisciplinary instruction, the identity of the separate disciplines is retained.

Irrespective of the semantic issues, attempts to interrelate the disciplines should consider focusing on real world problems or issues (e.g., alternative eating, discrimination) that have relevance to youth. Problem-based learning (Stepien & Gallagher), and guiding questions with "intellectual bite" and "emotive force" (Traver, 1998), can be employed. Relative to the latter, one could pose, "How might the adoption of vegetarianism by developed countries impact our planet (or global warming, world hunger, our society, our economy, and so on)?

Connecting the disciplines for meaningful learning is often accomplished in elementary education. However, this is considerably more difficult at the high school level, and achieving

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such on a long term basis is confounded by a host of barriers and issues (Miller & Davison, 1998). These may include: (a) a "top down" edict by administration to implement a specific curriculum, (b) a "gung ho" approach to realizing interdisciplinary instruction (i.e., entire courses are overhauled/combined instead of a phased/unit approach), (c) being relatively uncomfortable or unfamiliar with alternative teaching and assessment strategies, (d) insufficient or ineffective inservices on interdisciplinary instruction, (e) lack of a common planning period, (f) no flexibility to schedule different subjects "back to back" or for block scheduling, (g) a need to preserve the integrity of individual disciplines (Lederman & Niess, 1997), and (h) demands (perceived or real) to "cover" an immense number of concepts within each discipline.

This workshop will familiarize participants with an "interdisciplinary" high school curriculum, which employs common themes that can be taught across the curriculum or in a variety of subjects. The themes are related to human nutrition. The workshop also will explore strategies to realize interdisciplinary instruction at the secondary level and discussions about ways the authors have used the curriculum for professional development of secondary teachers, including science teachers who participate in a Health Sciences and Technology Academy (http://nt-hsta/hsc.wvu.edu/health) (Rye, 1998). The curriculum is especially relevant to science educators and science teachers because of the focus on nutrition: a subject matter area that is founded on the principles of biology and chemistry (Guthrie, 1989, Spallholz, 1989) and allows for the learning of science as well as mathematics in authentic contexts (Rye, in press).

Curriculum Development

The *Secondary Level Interdisciplinary Curriculum* (SLIC) (Campbell & Meyers, 1997) is a high school curriculum published by the Pennsylvania Department of Education, Nutrition Education and Training Program (NET). It was developed with funding from the United States Department of Agriculture by a team of curriculum specialists, nutritionists, and secondary teachers from a variety of disciplines (e.g., sciences, mathematics, English, history), and

included the pilot testing of lessons by 65 teachers and over 1800 students in Pennsylvania. Additionally, some of the science lessons were pre-pilot tested through instructional settings "beyond the classroom:" extracurricular science clubs and a summer institute that were part of the Health Sciences and Technology Academy at West Virginia University (Rye, 1998).

The 16 lessons in SLIC were developed "by teachers for teachers" in an effort to maximize the chances that the curriculum actually would be used in a variety of disciplines/teachers' courses at the high school level. For example, all high school students in the United States study prohibition in their American history course. SLIC's history lesson on "Prohibition in the U.S. and the Debate Today" can be used by these students to research and debate the alcohol-nutrient issues involved with alcohol consumption.

Curriculum Description and Approach

SLIC is organized around five thematic units that present nutrition issues highly relevant to adolescents: Alternative Eating, Food Safety, Physical Activity, Disordered Eating, and Special Concerns in Nutrition for Teenagers. Each thematic unit is comprised of three to four lessons that are taught through different disciplines, which include algebra, American history, biology, business education/consumer math, chemistry, English, environmental science, family and consumer sciences, and health. Accordingly, SLIC employs a multidisciplinary approach: The integrity of the different secondary level disciplines can be maintained while facilitating understandings of interconnectedness, as advocated by Lederman and Niess (1997).

For any theme, it is recommended that all teachers from the affected disciplines try to teach their lessons within the same 3 to 4 week time period. For example, the theme "Alternative Eating" includes one lesson each from algebra, English, business education/consumer math, and environmental science. The respective lessons, which would all be taught during the same month, would be "DeCarte's Recipe Mania," "Decisions, Decisions," "A Balancing Act: Food, Family, and Fitness," and "What's the Beef About Methane?" These

lessons attempt to facilitate understandings about vegetarian lifestyle choices and the effect of these choices on global warming, personal health, restaurant economics, and family food budgets. A common skill that is taught in English class is how to make an informed decision utilizing important criteria. In the lesson, "Decisions, Decisions," students work on this skill by researching different types of alternative eating styles such as low fat, ovolacto vegetarians, vegans, and Mediterranean diet, and develop a decision-making matrix to evaluate these eating styles. This topic is particularly important to examine at this age because high school students now make up the largest group of vegetarians, and many are choosing vegetarian or alternative eating styles based on inadequate information.

Lessons in biology and chemistry include "Hamburger Sizzler," which targets food poisoning, and "Titrating Calcium from Milk Products," which addresses osteoporosis and bioavailability. Through development of the latter concept, students come to understand that nutrient content of the food and the degree to which that nutrient is absorbed need to be considered in accurately determining how much of a given nutrient is available for metabolic processes. For example, only about 5% of the calcium in spinach is absorbed whereas over 60% of the calcium in green cabbage is absorbed (calcium from milk has a bioavailability of about 32%). In addition to global warming, environmental science lessons focus on "Pesticides in our Foods."

Certain lessons that are taught through other disciplines also contain science content and can facilitate science literacy as it relates to human health. For example, the history lesson mentioned above on the Prohibition era includes information on the physiological effects of alcohol. A health lesson entitled "Fat Phobia" helps students "restructure" the alternative conception that the healthiest diet is one with no fat. This lesson develops understandings about the variety of physiological functions of fat (e.g., carries and stores fat soluble vitamins), the amounts of fat needed (at least 15% and up to 30% of total daily calories should come from fat), and how to construct or modify diets to provide for adequate fat intake.

Science teachers who have a special interest or a secondary teaching emphasis in health may find SLIC especially useful. In reference to disease prevention and health promotion, SLIC provides for the integration of nutrition subject matter into the school curriculum far beyond those disciplines--health and family and consumer sciences--that are the traditional vehicles for nutrition education. Accordingly, students who engage in learning experiences through SLIC will have considerably more opportunities for constructing nutrition knowledge. Students should emerge with greater understandings about disordered eating, food safety, special concerns in nutrition for teens (e.g., calcium and iron intake), alternative eating, and physical activity, which ideally will translate to lifestyle behaviors that promote health. Students who complete the experiences from this curriculum also will possess a higher level of citizenship nutrition literacy, which should enhance their ability to discern "fact from fiction" in the popular press.

SLIC is designed to address state and national standards for science, math, language arts, and allied arts. For example, the subject matter presented is central to "personal and community health" within the "Science in Personal and Social Perspectives" content standard of the National Science Education Standards (National Research Council, 1996). The curriculum incorporates a variety of instructional strategies and tools, such as graphic organizers, the Expert Jigsaw, PMI charts, and the Internet, which facilitate an experiential approach to learning. Example uses of the previous include: a Venn diagram to contrast students' conceptions with a nutrition expert's conceptions of what constitutes "normal eating;" and an Expert Jigsaw where students teach each other what they learned from readings that pertain to methane production. The curriculum also embeds a host of alternatives to traditional methods of assessing learning outcomes. Such assessments include the use of rubrics and range from student-constructed products (e.g., portfolios, journals, and simulations) to student performances (e.g., demonstrations, oral presentations, and debates). A robust example of a product is the preparation of an environmental impact statement that surrounds beef and rice production and consumption, which is assigned near the end of the lesson on "What's the Beef About Methane?" SLIC also provides an appropriate balance of performance-based assessment methods across content areas. An

example performance assessment utilized near the end of the American history lesson, "Prohibition in the U.S. and the Debate Today," is a structured debate that addresses the question, "Should alcohol consumption remain illegal for teens?"

Dissemination, Impact, and Implications

The Pennsylvania Department of Education has distributed a copy of SLIC to every public high school and many non-public high schools in Pennsylvania, and the NET Program offices in all 50 states. Teachers or other professionals (e.g., Cooperative Extension staff and teacher educators at post-secondary institutions) interested in the topics presented by the curriculum can obtain SLIC for preview from their state NET office, and can make a copy of it. In addition, SLIC is listed in the National Agriculture Library Food and Nutrition Information Center catalog: Teachers and other professionals from anywhere in the United States can request SLIC for preview from the National Agriculture Library via their local or school library. SLIC also can be ordered from Creative Enterprises (see Campbell & Meyers, 1997).

Approximately 1200 teachers in Pennsylvania have been reached through training programs on SLIC. For the 1999-2000 school year, the Pennsylvania Department of Education plans to provide start-up grants to high schools in Pennsylvania to implement SLIC in an interdisciplinary manner. A comprehensive evaluation of the degree to which (and how) the curriculum has been implemented in Pennsylvania has not yet been conducted. Evaluations of SLIC training attended by 32 teacher-participants of the Health Sciences and Technology Academy (HSTA) were very impressive, with the majority of teachers responding that they planned to use the lessons "a great deal" in HSTA or their regular school classrooms. Various open-ended responses provided by HSTA teachers corresponded directly to intended features of the curriculum, e.g., "Nutrition information will provide [a] great activity-based learning project," "The entire nutrition program could be used as a starting point to develop a [HSTA] club project and/or individual student projects," and "All of the 4's and 5's [high ratings] are directly related to the interests of all teenager[s], not just HSTA kids."

The innovative nature and potential contribution of SLIC recently was recognized by the American Dietetic Association: The curriculum received the 1998 President's Circle Nutrition Education Award. Instruction from SLIC can promote a greater degree of citizenship scientific literacy amongst students relative to understanding their own body and discerning "fact from fiction" about health information in the popular press. Further, teachers who utilize the curriculum have the opportunity to learn new concepts in human nutrition as well as increase their familiarity with a diversity of teaching and assessment strategies. The curriculum also can impact school specialists in curriculum and instruction and teacher education faculty because it can serve as a model for multidisciplinary instruction at the secondary level.

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